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Lime and Tillage Research Project

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Abstract
Farmers growing corn and soybeans in northwest Iowa have to consider the cost of ag lime when liming their soils. This is because of high limestone costs and the fact that the soils in northwest Iowa have high pH subsoil. The high pH subsoil moderates the negative effect of acid surface soils. Another factor that must be considered is the variable mixing of limestone into the soil with different tillage systems. The different amounts of soil mixing between no-till systems, ridge-till systems, and conventional tillage systems may affect the amount of limestone needed to correct the soil pH and crop yields.

Disciplines
Agricultural Science | Agriculture

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Introduction

Farmers growing corn and soybeans in northwest Iowa have to consider the cost of ag lime when liming their soils. This is because of high limestone costs and the fact that the soils in northwest Iowa have high pH subsoil. The high pH subsoil moderates the negative effect of acid surface soils. Another factor that must be considered is the variable mixing of limestone into the soil with different tillage systems. The different amounts of soil mixing between no-till systems, ridge-till systems, and conventional tillage systems may affect the amount of limestone needed to correct the soil pH and crop yields.

Materials and Methods

An experiment was designed to evaluate different rates of ag lime with three different tillage systems in 1994. The soils in the experimental area consist of Galva, Primghar, and Marcus soils that are typical of the predominant upland soils in northwest Iowa. The initial pH of the surface 0–6 inches in the experimental area was 5.6 in 1993. Results of the first nine years of this experiment are shown. All rates of limestone are expressed in effective calcium carbonate equivalent (ECCE).

Results and Discussion

Soil pH was increased with aglime application in this experiment (Tables 1 and 2). The amount of pH correction occurred mostly at the position the ag lime was incorporated into the soil. The no-till and ridge-till systems corrected the pH in the top two inches of soil and had little effect on pH at the two- to six-inch level.

Soil pH information from 1995 and 1997 is reported in the 1999 Annual Progress Report for the Northwest Research Farm. The effect of tillage system on crop yield was analyzed for the 1994 to 1998 data and is reported in the 1999 Annual Progress Report also.

Information from this experiment shows that low rates of limestone (1,000 or 2,000 lb/acre of ECCE) can increase soybean yields on the short term with relatively small effects on pH. It seems from these data that the high rates of limestone (4,000 or 6,000 lb/acre of ECCE) had less effect on improving soybean yields after eight or nine years, compared with yields more immediately after the lime application. However, the higher rates of limestone seem to have an effect on soil pH after eight years. It could be that the lower yield levels of soybeans in 2001 and 2002 may have reduced the crop response from limestone applications.

The highest rate of limestone (6,000 lb/acre of ECCE) did produce the highest soybean yields and maintained the soil pH above 6.0. There was no effect of liming on corn yields.

The application of ag lime did not affect corn yield any year of the experiment. Ag lime applications also seemed to be effective even when ag lime incorporation was minimal, as is the case with no-till and ridge-till systems.

Table 1. Effect of ag lime on soil pH, fall 1999.

Tillage	No-till		Ridge-till		Chisel plow	
Sample depth, in.	0–2	2–6	0–2	2–6	0–2	2–6
ECCE/a	---------- soil pH----------					
0	5.2	5.6	5.3	5.7	5.3	5.6
500	5.3	5.6	5.4	5.7	5.5	5.7
1000	5.5	5.7	5.4	5.7	5.7	5.8
2000	5.5	5.7	5.6	5.7	5.7	5.8
4000	6.0	5.8	6.1	5.8	5.9	5.9
6000	6.5	5.9	6.3	5.8	6.2	6.0

Table 2. Effect of ag lime on soil pH, fall 2001.

Tillage	No-till		Ridge-till		Chisel plow	
Sample depth, in.	0–2	2–6	0–2	2–6	0–2	2–6
ECCE/a	---------- soil pH----------					
0	5.2	5.7	5.3	5.7	5.4	5.7
500	5.4	5.8	5.5	5.7	5.5	5.8
1000	5.6	5.9	5.5	5.8	5.6	5.8
2000	5.9	5.9	5.7	5.9	5.6	5.9
4000	6.1	5.9	6.0	6.0	5.9	6.0
6000	6.7	6.1	6.4	6.0	6.2	6.2

Table 3. Effect of ag lime on corn yield, bushels/acre.

Ag lime	Year									
ECCE, lb/a	1994	1995	1996	1997	1998	1999	2000	2001	2002	Avg
0	171	144	122	153	152	164	144	156	141	150
500	168	146	126	150	149	163	141	152	140	148
1000	170	145	130	148	152	166	145	154	144	150
2000	170	144	136	148	153	161	140	151	138	149
4000	171	144	128	151	156	162	140	147	142	149
6000	166	146	127	149	154	162	140	154	142	149

Table 4. Effect of ag lime on soybean yield, bushels/acre.

Ag lime	Year									
ECCE, lb/a	1994	1995	1996	1997	1998	1999	2000	2001	2002	Avg
0	35.2	42.1	45.7	49.6	44.7	47.8	46.2	44.1	35.7	43.4
500	35.5	44.6	44.7	50.2	44.9	48.4	46.3	43.3	34.6	43.6
1000	38.1	45.8	47.1	54.5	46.5	50.6	47.7	44.6	36.8	45.8
2000	38.2	46.3	47.2	54.1	47.0	49.2	48.0	44.5	37.3	45.7
4000	37.7	46.8	47.6	57.9	46.7	51.5	49.5	44.8	37.3	46.6
6000	38.7	46.6	49.8	57.2	48.4	52.0	49.7	45.2	37.7	47.3